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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE APPLICATION OF

YONG CHE ET AL : EXAMINER: ALEJANDRO, R.

SERIAL NO: 10/091,502 :

FILED: MARCH 7, 2002 : GROUP ART UNIT: 1745

FOR: SECONDARY POWER SOURCE :

APPEAL BRIEF

COMMISSIONER FOR PATENTS  
ALEXANDRIA, VIRGINIA 22313

SIR:

This is an appeal of the Final Rejection dated November 14, 2003 of Claims 1-16. A Notice of Appeal is **submitted herewith**.

I. REAL PARTY IN INTEREST

The real party in interest in this appeal is Asahi Glass Company, Ltd. having an address 12-1 Yurakucho 1-chome, Chiyoda-ku, Tokyo, 100-8405, Japan.

II. RELATED APPEALS AND INTERFERENCES

Appellants, Appellants' legal representative and the assignee are aware of no appeals or interferences which will directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

III. STATUS OF THE CLAIMS

Claims 1-16, all the claims in the application, stand rejected and are herein appealed.

IV. STATUS OF THE AMENDMENTS

No Amendment under 37 CFR 1.116 has been filed.

V. SUMMARY OF THE INVENTION

As recited in Claim 1, the invention is a secondary power source, which comprises: a positive electrode consisting essentially of activated carbon, from 0.1 to 20% by weight of a conductive material, and 1 to 20% by weight of a binder based on the total mass of the positive electrode,

a negative electrode consisting essentially of a carbon material capable of doping and undoping lithium ions and 4 to 30% by weight of a binder based on the total mass of the negative electrode, and

an organic electrolyte containing a lithium salt,

wherein the negative electrode has a density of from 0.6 to 1.2 g/cm<sup>3</sup>.

As recited in Claim 11, the invention is also a secondary power source, which comprises a positive electrode containing activated carbon, a negative electrode containing a carbon material capable of doping and undoping lithium ions, and an organic electrolyte containing a lithium salt, wherein the negative electrode has a density of from 0.7 to 1.0 g/cm<sup>3</sup>.

See the specification at page 4, lines 6-12 and page 8, lines 10-13.

VI. ISSUES

(A) Whether Claims 1-2, 5-8, 11-12 and 15-16 are unpatentable under 35 U.S.C. § 103(a) over JP 2000-090972 (Kuruma et al) in view of U.S. 6,399,251 (Honbo et al)?

(B) Whether Claims 3-4, 9-10 and 13-14 are unpatentable under 35 U.S.C. § 103(a) over Kuruma et al in view of Honbo et al, and further in view of U.S. 6,103,373 (Nishimura et al)?

(C) Whether Claims 11-12 are unpatentable under the judicially created doctrine of obviousness-type double patenting over Claims 1, 3, 7 and 15 of U.S. 6,294,292 (Tsushima et al '292) in view of Honbo et al?

(D) Whether Claims 11-12 are unpatentable under the judicially created doctrine of obviousness-type double patenting over Claims 1, 3, 5 and 7-8 of U.S. 6,558,846 (Tsushima et al '846) in view of Honbo et al?

VII. GROUPING OF THE CLAIMS

For Issues (A) and (B) above, the claims all stand or fall together with Claim 1.

For Issues (C) and (D) above, the claims all stand or fall together with Claim 11.

VIII. ARGUMENT

The rejections under:

35 U.S.C. § 103(a) of Claims 1-2, 5-8, 11-12 and 15-16 as unpatentable over Kuruma et al in view of Honbo et al, and of Claims 3-4, 9-10 and 13-14 over Kuruma et al in view of Honbo et al, and further in view of Nishimura et al; and

under the judicially created doctrine of obviousness-type double patenting of Claims 11-12:

over Claims 1, 3, 7 and 15 of Tsushima et al '292 in view of Honbo et al, and

over Claims 1, 3, 5 and 7-8 of Tsushima et al '846 in view of Honbo et al,

are respectfully traversed.

These rejections are untenable and should not be sustained.

The present invention, in its broadest disclosed embodiment, is drawn to a secondary power source, which comprises a positive electrode containing activated carbon, a negative electrode containing a carbon material capable of doping and undoping lithium ions, and an organic electrolyte containing a lithium salt, wherein the negative electrode has a density of from 0.6 to 1.2 g/cm<sup>3</sup>.

As described in the specification at page 1, first full paragraph, the inventive secondary power source has a high upper limit voltage, a large capacity and a high reliability for large current charge and discharge cycles.

As described in the specification beginning at page 1, line 6, the prior art has distinguished various secondary power source materials, such as electric double layer capacitors and lithium ion secondary cells based on the particular materials used for the positive electrode and the negative electrode. The materials affect properties such as upper limit voltage, capacity and durability against quick charge and discharge cycles. Appellants have discovered a particular problem with regard to a particular secondary power source, i.e., one that comprises a positive electrode containing activated carbon, a negative electrode containing a carbon material capable of doping and undoping lithium ions, and an organic electrolyte containing a lithium salt. In effect, Appellants discovered that the density of the

negative electrode is a result-effective variable that affects both the initial capacity and the change in capacity.

In other words, Appellants have discovered a correlation between the density of the negative electrode and cycle performance of quick charge and discharge. Namely, they have found that the lower the density of the negative electrode, the lower the rate of decrease in capacity due to quick charge and discharge, and when the density becomes lower than a predetermined value, the rate of decrease in capacity becomes substantially constant, as described in the specification bridging pages 6 and 7.

Appellants describe, beginning in the specification at page 4, line 25, that a secondary cell as well as an electric double layer capacitor is a kind of a secondary power source but, in the present specification, a secondary power source of a specific construction wherein the positive electrode contains activated carbon and the negative electrode contains a carbon material capable of doping and undoping lithium ions, will be referred to simply as a secondary power source.

In the specification, beginning at page 5, line 6, Appellants distinguish the secondary power source of the present invention compared to a lithium ion secondary cell:

In a lithium ion secondary cell, the positive electrode is an electrode composed mainly of a lithium-containing transition metal oxide, and the negative electrode is an electrode composed mainly of a carbon material capable of doping and undoping lithium ions. Lithium ions are undoped from the lithium-containing transition metal oxide in the positive electrode by charging and doped in the carbon material capable of doping and undoping lithium ions in the negative electrode, and lithium ions are undoped from the negative electrode by discharging and doped in the positive electrode. Accordingly, lithium ions in an electrolyte are not substantially involved in charge and discharge of the cell.

On the other hand, in the secondary power source of the present invention, anions in the electrolyte are adsorbed on the activated carbon in the positive electrode by charging, and lithium ions in the electrolyte are doped in the carbon material capable of doping and undoping lithium ions in the negative electrode. Further, by discharging, lithium ions are

undoped from the negative electrode and anions are desorbed from the positive electrode. Namely, in the secondary power source of the present invention, the solute in the electrolyte is substantially involved in the charge and discharge, and the mechanism of the charge and discharge is different from that of the lithium ion secondary cell. Further, doping and undoping of lithium ions are not involved in the positive electrode of the secondary power source of the invention, which is different from the lithium ion secondary cell, and the positive electrode does not deteriorate due to doping and undoping of lithium ions, and accordingly the secondary power source of the present invention is less likely to deteriorate by charge and discharge cycles as compared with the lithium ion secondary cell, and is excellent in a long-term reliability.

Kuruma et al, and the claims of both Tsushima et al patents, disclose nothing more than what Appellants have already described in the specification as known. The Examiner concedes that none of this prior art discloses or suggests the presently-recited negative electrode density.

The Examiner relies on Honbo et al as describing a lithium secondary battery with a negative electrode of a carbon material having a density in the range of 0.95-1.5 g/cm<sup>3</sup>. However, the positive electrode material of Honbo et al is a "complex oxide containing Li and Mn, which has a spinel type crystalline structure" (column 2, lines 38-40). Honbo et al discloses that the density range of 0.95-1.5 g/cm<sup>3</sup> of the negative electrode material prevents the precipitation of Mn (dissolved from the positive electrode material) on and inside the negative electrode (column 4, lines 5-17). Thus, Honbo et al discloses that the density range of the negative electrode material of Honbo et al should be selected to minimize a failure mode which is specific to the Li/Mn oxide composition of the positive electrode material of Honbo et al.

However, the claimed secondary power source has a completely different kind of positive electrode material (i.e. activated carbon) which cannot fail in the manner described in Honbo et al (activated carbon does not contain the Mn ions which Honbo et al discloses can precipitate in the negative electrode material). Consequently, the specific failure mode

described in Honbo et al is not possible in the claimed secondary power source or, for that matter, in the secondary power sources of Kuruma et al, or the claims of the Tsushima et al patents. Thus, one of ordinary skill in the art of preparing secondary power sources would not reasonably consider the disclosure of Honbo et al to apply to the secondary power source of Kuruma et al, or the claims of the Tsushima et al patents, in which the positive electrode material comprises activated carbon. Accordingly, Honbo et al does not reasonably suggest combining an activated carbon positive electrode with a carbon material negative electrode having a density in the claimed range.

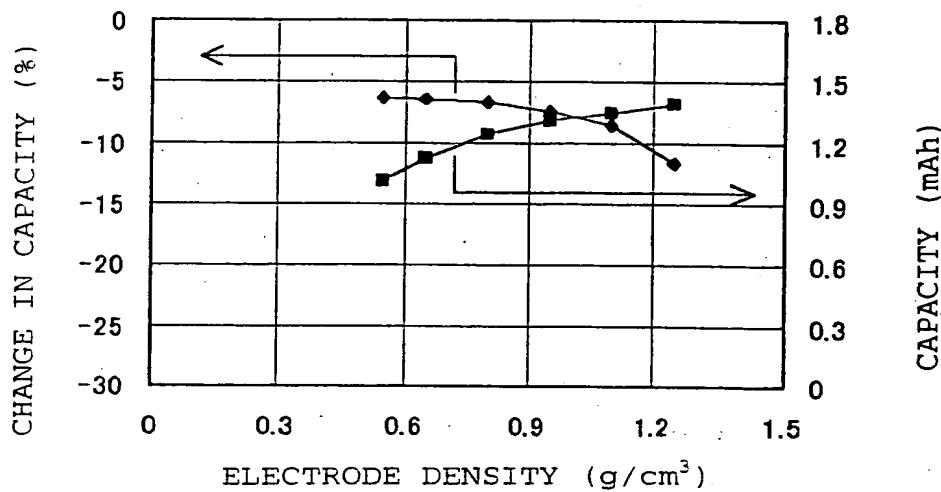
As described above, none of the other applied references describes the density of the negative electrode material, and therefore fail to recognize that the negative electrode density is result-effective in a secondary power source having an activated carbon positive electrode material and a carbon material negative electrode material. Accordingly, the combination of Honbo et al and the remaining applied references also fails to suggest the claimed secondary power source.

Furthermore, Table 1 at page 17 of the present specification demonstrates the criticality of the claimed density range of the negative electrode. Example 6 is a secondary power source which is otherwise identical to that of Example 1, except that the negative electrode density is  $0.55 \text{ g/cm}^3$ , and Example 7 is a secondary power source otherwise identical to that of Example 1, except that the density of the negative electrode is  $1.25 \text{ g/cm}^3$ . In other word, the secondary power source of Example 6 has a negative electrode density somewhat lower than that of the claimed range, and the secondary power source of Example 7 has a negative electrode density somewhat higher than that of the claimed range. The secondary power source of Example 6 has a significantly lower initial capacity than that of Example 1, and the secondary power source of Example 7 has a significantly greater

reduction in capacity after 2000 cycles, compared to Example 1. Thus, the claimed secondary power source has superior performance characteristics compared to otherwise identical secondary power sources having a negative electrode density outside the claimed range. Accordingly, none of the applied references, either individually or in combination, suggest the claimed secondary power source.

The above-discussed data is graphically shown in Fig. 1 of the specification, reproduced below:

FIG. 1



In response to the above arguments, the Examiner finds in the Final Rejection that "the fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985)."

In reply, *Obiaya* is inapposite, because the prior art does **not** suggest the present invention. Honbo et al is an example of a lithium ion secondary cell, discussed above and described in the specification herein at page 5, lines 6-19, which operates according to a different mechanism from that of the secondary power source of, for example, Kuruma et al, the claims of the Tsushima et al patents, and the present invention. Indeed, the lithium secondary battery of Honbo et al is irrelevant with regard to secondary power sources of the specific construction herein, and of Kuruma et al and the claims of the Tsushima et al patents. Nor do Appellants agree that Honbo et al is even within the inventor's field of endeavor, which field does not include lithium ion secondary cells in which the positive electrode is composed mainly of a lithium-containing transition metal oxide.

Regarding the Examiner's criticism of the comparative data of record, Appellants respectfully submit that there is no *prima facie* case of obviousness, so that any criticisms are moot. Nevertheless, even if there was such a *prima facie* case, it is respectfully submitted that the Examiner is being overly strict. The Examiner has offered no reasons why one skilled in the art would have expected different conclusions using, for example, as constants, different binder materials, conducting agent materials, current collector materials, electrolytes, and the like. Indeed, in each of Examples 1 to 4, 6 and 7, the only variable was the negative electrode density. The Examiner has not explained why one skilled in the art would not accept the evidence of record as demonstrating the significance of the negative electrode density.

As further evidence that Honbo et al does not present a *prima facie* case of obviousness, the comparative data of Honbo et al demonstrates that for purposes of Honbo et al's invention, a negative electrode density within a particular range, while necessary, is not sufficient. Honbo et al require that a number of variables therein be satisfied, such as half

value of the peak (400), average primary particle diameter, specific surface area of secondary particles, lattice constant of active material, in addition to negative electrode density. Indeed, Honbo et al's Comparative Examples 1, 3 and 4 show that even when the density is within Honbo et al's range, their battery is deficient because all the other variables are not satisfied. Interestingly, the battery of Honbo et al's Comparative Example 2 is deficient when the density is 0.91 g/cm<sup>3</sup>, which density is outside Honbo et al's range but well within Appellants' range.

The remainder of this Appeal Brief is directed to the Examiner's Response to Arguments in the Advisory Action, entered February 17, 2004.

Regarding Appellants' argument that it is they who discovered that the negative electrode density is a result-effective variable, the Examiner appears to fail to appreciate both Appellants' point and the legal ramifications flowing therefrom. Indeed, the Examiner completely misconstrues Appellants' argument by stating that Appellants "basically [agrees] with the fact the negative electrode density should not be considered a result-effective variable at all" (page 2). The Examiner then incorrectly concludes that "since [Appellants] share the same opinion that the prior art failed to recognize the negative electrode density as a result-effective variable, it is therefore noted that the negative electrode density does not impart criticality in the secondary power source and, hence it is not supportive of patentable subject matter" (*id.*).

While the Examiner cites MPEP § 2144.05, he ignores applicable precedent therein, such as *In re Antonie*, 559 F.2d 618, 195 USPQ 6 (CCPA 1977) (exceptions to rule that optimization of a result-effective variable is obvious, such as where the results of optimizing the variable are unexpectedly good or where the variable was not recognized to be result effective). Appellants are entitled to prevail under either of the above exceptions.

While this section of the MPEP also describes case precedent regarding optimization of ranges, note that the applied prior art discloses **no** range for a negative electrode density for a secondary power source of the type claimed herein, i.e., the type disclosed in Kuruma et al and the claims of the Tsushima et al patents.

Regarding the Examiner's finding that the disclosures of "both" [sic, all] references are directed to batteries or electrochemical cells having organic electrolyte systems and that, in effect, the negative electrode of Honbo et al "performs exactly the identical function" as in the present claims and the prior art of Kuruma et al, and the claims of the Tsushima et al patents (page 3), Appellants respectfully submit that in the context of the present invention, Honbo et al is from a different field of endeavor from Kuruma et al and the claims of the Tsushima et al patents, because a secondary power source having an activated carbon positive electrode material is from a different field of endeavor from a lithium ion secondary cell having a positive electrode composed mainly of a lithium-containing transition metal oxide since, as discussed above, the mechanism of the charge and discharge differs from each type of source. It is worth noting that the Examiner never addresses this argument, because there is no rejoinder.

Regarding the Examiner's findings that any showing of superior results have not been shown to be unexpected, and if unexpected, not commensurate in scope with the claims, and if shown to be unexpected, not shown to have a significance equal to or greater than expected properties (pages 3-5), these findings have been addressed above. Thus, no *prima facie* case of obviousness has been made out; therefore, Appellants were under no burden to show unexpected results. Nevertheless, they have shown unexpected results with regard to the presently-recited range of the negative electrode density.

Regarding the Examiner's analysis of the data as shown in above-discussed Figure 1 (pages 5-6), the fact that better results might be obtained in a narrower range within the broader ranges of 0.6 to 1.2, or 0.7 to 1.0, g/cm<sup>3</sup> does not detract from the fact that it has been shown that these broader ranges provide results unexpectedly better than outside these ranges.

The Examiner continues to rely on *Obiaya, supra* with regard to the above-discussed argument about Honbo et al's particular positive electrode material and the purpose of the density limitation of Honbo et al's negative electrode material (pages 6-7). But this argument is not a recognition of another advantage which would flow naturally from following the suggestions of the prior art. Rather, this argument is simply that one skilled in the art would not combine the prior art as the Examiner has.

Finally, with regard to the Examiner's discussion of the double patenting rejections (pages 7-8), his point is not understood. Claims 11 and 12 do not contain "consisting essentially of" language.

For all the above reasons, it is respectfully requested that the above rejections be REVERSED.

IX. CONCLUSION

For the above reasons, it is respectfully requested that all the rejections still pending in the Final Office Action be REVERSED.

Respectfully submitted,

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## APPENDIX

### CLAIMS ON APPEAL

1. A secondary power source, which comprises:

a positive electrode consisting essentially of activated carbon, from 0.1 to 20% by weight of a conductive material, and 1 to 20% by weight of a binder based on the total mass of the positive electrode,

a negative electrode consisting essentially of a carbon material capable of doping and undoping lithium ions and 4 to 30% by weight of a binder based on the total mass of the negative electrode, and

an organic electrolyte containing a lithium salt,

wherein the negative electrode has a density of from 0.6 to 1.2 g/cm<sup>3</sup>.

2. The secondary power source according to Claim 1, wherein the carbon material contained in the negative electrode has a lattice spacing of [002] face of from 0.335 to 0.410 nm as measured by X-ray diffraction.

3. The secondary power source according to Claim 1, wherein the negative electrode contains vapor grown carbon fibers, and the carbon fibers are contained in an amount of from 5 to 30% based on the total mass of the negative electrode.

4. The secondary power source according to Claim 3, wherein the carbon fibers have a lattice spacing of [002] face of from 0.336 to 0.337 nm as measured by X-ray diffraction.

5. The secondary power source according to Claim 1, wherein the negative electrode contains a binder in an amount of from 5 to 30% based on the total mass of the negative electrode.

6. The secondary power source according to Claim 5, wherein the binder is polyvinylidene fluoride.

7. The secondary power source according to Claim 1, wherein the activated carbon has a specific surface area of from 800 to 3,000 m<sup>2</sup>/g.

8. The secondary power source according to Claim 1, wherein the organic electrolyte comprises as a solvent at least one member selected from the group consisting of ethylene carbonate, propylene carbonate, butylene carbonate, dimethyl carbonate, ethylmethyl carbonate, diethyl carbonate, sulfolane and dimethoxyethane, and as the lithium salt at least one member selected from the group consisting of LiPF<sub>6</sub>, LiBF<sub>4</sub>, LiClO<sub>4</sub>, LiN(SO<sub>2</sub>CF<sub>3</sub>)<sub>2</sub>, LiN(SO<sub>2</sub>C<sub>2</sub>F<sub>5</sub>)<sub>2</sub>, CF<sub>3</sub>SO<sub>3</sub>Li, LiC(SO<sub>2</sub>CF<sub>3</sub>)<sub>3</sub>, LiAsF<sub>6</sub> and LiSbF<sub>6</sub>.

9. The secondary power source according to Claim 3, wherein the negative electrode contains a binder in an amount of from 5 to 30% based on the total mass of the negative electrode.

10. The secondary power source according to Claim 9, wherein the binder is polyvinylidene fluoride.

11. A secondary power source, which comprises a positive electrode containing activated carbon, a negative electrode containing a carbon material capable of doping and undoping lithium ions, and an organic electrolyte containing a lithium salt, wherein the negative electrode has a density of from 0.7 to 1.0 g/cm<sup>3</sup>.

12. The secondary power source according to Claim 11, wherein the carbon material contained in the negative electrode has a lattice spacing of [002] face of from 0.335 to 0.410 nm as measured by X-ray diffraction.

13. The secondary power source according to Claim 11, wherein the negative electrode contains vapor grown carbon fibers, and the carbon fibers are contained in an amount of from 5 to 30% based on the total mass of the negative electrode.

14. The secondary power source according to Claim 13, wherein the carbon fibers have a lattice spacing of [002] face of from 0.336 to 0.337 nm as measured by X-ray diffraction.

15. The secondary power source according to Claim 11, wherein the negative electrode contains a binder in an amount of from 5 to 30% based on the total mass of the negative electrode.

16. The secondary power source according to Claim 15, wherein the binder is polyvinylidene fluoride.